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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/574,073	03/30/2006	Takeo Watanabe	SHIGA7.047APC	3794
20995 7590 06/21/2007 KNOBBE MARTENS OLSON & BEAR LLP 2040 MAIN STREET FOURTEENTH FLOOR IRVINE, CA 92614			EXAMINER WALKE, AMANDA C	
			ART UNIT	PAPER NUMBER
			1752	
			NOTIFICATION DATE	DELIVERY MODE
			06/21/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/574,073	Applicant(s) WATANABE ET AL.	
	Examiner Amanda C. Walke	Art Unit 1752	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 2 is objected to because of the following informalities: The bracket before “film thickness”, before “wherein” and after “seconds” should be deleted. Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Szmanda et al (6,787,286).

Szmanda et al disclose photoresists that are suitable for short wavelength imaging, particularly sub-170 nm such as 157 nm. Resists of the invention comprise a fluorine-containing polymer, a photoactive component, and a solvent component. Preferred solvents for use on the resists of the invention can maintain the resist components in solution and include one or more preferably two or more (i.e. blends) of solvents. In particularly preferred solvent blends of the invention, each blend member evaporates at substantially equal rates, whereby the resist composition maintains a substantially constant concentration of each blend member. Novel photoresist compositions are provided that comprise a fluorine-containing polymer, a photoactive component particularly a photoacid generator compound, and solvent. Resists of the invention are particularly suitable for imaging at extremely short wavelengths, such as sub-170

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nm, particularly about 157 nm. In one aspect, preferred solvents for use in resists of the invention include heptanone, particularly 2-heptanone (*methyl-n-amyl-ketone*) and 3-heptanone; ethyl-n-amyl-ketone; ethylene glycol ethyl ether; propylene glycol methyl ether acetate; amyl acetate; *methyl iso-amyl ketone*; methyl ethyl ketone; ethylene glycol methyl ether acetate; methylamyl acetate; ethylene glycol methyl ether acetate; ethyl-n-butyl ketone; iso-butyl isobutyrate; 2-methyl-1-pentanol (hexanol); ethylene glycol propyl ether; propylene glycol t-butyl ether; methylcaproate; ethyl caproate (ethyl hexanoate); cumene (isopropylbenzene); xylenes; anisole; cyclohexanone; ethylene glycol ethyl ether acetate; 1-tridecanol; cyclohexanol; mesitylene; hexyl acetate (2-methyl-1-pentyl acetate); diethylene glycol dimethyl ether (diglyme); diisobutyl ketone; di-n-propyl carbonate; diacetonealcohol; ethylene glycol butyl ether; and propylene glycol butyl ether. In another aspect, preferred solvents for use in resists of the invention are halogenated materials, particularly fluorinated materials. Such halogenated solvents can be particularly effective in solubilizing a fluorinated resin of a resist of the invention. Exemplary halogenated solvents for use in resists of the invention include halogenated aromatic solvents such as chlorobenzene, fluorobenzene, trifluoromethylbenzene, bis-(trifluoromethyl)benzene, and the like; perfluoroalkyl solvents; and fluoroethers such as HFE-700, FC-43, and FC-3248 (all available from the 3M Corporation) and other fluoroether solvents and other fluorinated solvents available from 3M Corporation; and the like. Resists formulations are also preferred that comprise a blend of solvents, wherein one of the blend members is a heptanone, preferably 2-heptanone. Other blend members may suitably be e.g. ethyl lactate, propylene glycol methyl ether acetate (PGMEA), diacetone alcohol, hexyl acetate, ethyl hexanoate, gamma-butyrolactone (GBL), diglyme, propylene glycol dimethyl ether, and *propylene glycol methyl ether*. Other

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solvent blends for use with resists of the invention include blends that comprise other ketones or other carbonyl functionalities (e.g., ester). It has been found that solvents that contain a carbonyl group can solvate a fluoropolymer more effectively than other non-carbonyl solvents. In particular, cyclohexanone, various dialkyl-ketone such as diisobutyl ketone and ethoxy ethyl propionate are preferred solvents for use in a resist formulation of the invention, including as a blend member with one or more other solvents such as ethyl lactate, propylene glycol methyl ether acetate (PGMEA), diacetone alcohol, hexyl acetate, ethyl hexanoate, gamma-butyrolactone (GBL), diglyme, propylene glycol dimethyl ether, and propylene glycol methyl ether. In general, a ketone solvent such as a heptanone or diisobutyl ketone, is more preferred than an ester-containing solvent such as *ethyl ethoxy propionate*.

The fluorine-containing resin component of a resist of the invention suitably contains a repeat unit derived from at least one ethylenically unsaturated compound. *Preferably the unsaturated group is an alicyclic group such as norbornene, cyclohexene, adamantene and the like.* The alicyclic unsaturated compound preferably has one or more substituents of fluorine, perfluoralkyl particularly C_{sub}.1-12 perfluoralkyl, or perfluoroalkoxy particularly C_{sub}.1-12 perfluoroalkoxy. Preferably, such a fluorine substituent is separated from the unsaturated carbons by at least one saturated carbon in order to not unduly inhibit the polymerization reaction. Also preferred are fluorinated olefinic compounds such as tetrafluorethylene (TFE) compounds and hexafluoroisopropanol compounds and derivatives thereof. As discussed above, resists of the invention may suitably comprise a basic additive. The basic additive can be used in relatively small amount (e.g. 0.1 to 1, 2 or about 3 weight percent of the photoactive component) and can significantly enhance lithographic performance, particularly resolution of a developed resist

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relief image. In particular, addition of an appropriate basic compound to a resist of the invention can effectively suppress undesired photoacid diffusion into masked areas following an exposure step. Preferred basic additives are amine compounds, including primary, secondary, tertiary and quaternary amines. Amines that are not highly nucleophilic are generally preferred to avoid undesired reaction of the base additive with other resist composition components such as the PAG and/or solvent.

The reference also teaches a method of forming a pattern wherein a coating layer of a resist of the invention is imaged with short-wavelength radiation, particularly sub-200 nm radiation, especially 157 nm radiation, and higher energy radiation having a wavelength of less than 100 nm, and otherwise high energy radiation such as *EUV*, *electron beam*, ion beam or x-ray. The invention further comprises articles of manufacture comprising substrates such as a microelectronic wafer having coated thereon the photoresists and relief images of the invention. In the resist, the resin is a fluorine-containing terpolymer consisting of norbornene; *t*-*butylacrylate* and tetrafluorethylene (TEE) units prepared by free radical polymerization of the monomers; the PAG is a compound of the Formula IIa above where X is methylene and R is --CF₃; the basic additive is DBU; the dissolution inhibitor is fluorinated cholic acid; the surfactant is Silwet 7604; the plasticizer is poly(ethylene glycol)dioleate; and the solvent is a 70:30 v/v blend of 2-heptanone and ethyl lactate. The formulated resist composition is spin coated onto HMDS vapor primed 4 inch silicon wafers and softbaked via a vacuum hotplate at 90 degrees C for 60 seconds. The resist coating layer is exposed through a photomask at 157 nm, and then the exposed coating layers are post-exposure baked at 110 degrees C. The coated wafers are then

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treated with 0.26N aqueous tetramethylammonium hydroxide solution to develop the imaged resist layer and provide a relief image.

Given the teachings of the reference, it would have been obvious to one of ordinary skill in the art to prepare the material of Szmanda et al choosing to employ PGME or MAK as the resist solvent.

Regarding claim 2, the claim as written simply requires a composition *capable* of exhibiting the claimed characteristics. Given that the material of Szmanda et al is so similar and comprises materials described as being suitable in the instant specification, it is the position of the examiner that the reference is capable absent evidence to the contrary.

Regarding claim 3, claim 3 is drawn to a composition not a method, however the claim appears to be attempting to claim a method step. From the MPEP:

§ 2113:

"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985)... "The Patent Office bears a lesser burden proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature" than when a product is claimed in the conventional fashion. In re Fessman, 180 USPQ 324, 326 (CCPA 1974). Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different

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process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 218 USPQ 289, 292 (Fed. Cir. 1983).

4. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Szmanda et al in view of Irie (6,855,485 pr 6,966,710).

Szmanda et al has been discussed above and the reference teaches a material comprising the same additives as the instant invention and teaches that the material is EUV or ebeam sensitive, however the method of the reference fails to specify whether or not the EUV exposure takes place in a vacuum.

In a known lithographic process using krypton fluoride (KrF) excimer laser radiation (with a wavelength of around 248 nm) or argon fluoride (ArF) excimer laser radiation (with a wavelength of around 193 nm), an exposure process is carried out in the air or nitrogen ambient. However, if the same exposure process is performed in such an ambient using EUV radiation, then the radiation is absorbed into oxygen or nitrogen molecules contained in the ambient, because the EUV radiation has a much shorter wavelength. This is why the EUV exposure process should be carried-out in a vacuum. The reference teaches that the EUV exposure is performed in a vacuum 1.0×10^{-6} Pa. Specifically, the EUV radiation is emitted from an EUV radiation source (not shown) at a wavelength of around 13 nm, for example, directed toward a reflective mask 23 and then reflected therefrom. Subsequently, the reflected part 24 of the EUV radiation is condensed by a reflection/demagnification optical system 25 to about 1/5, for example, and then allowed to be incident onto the resist film 21. As a result, the resist film 21

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comes to have exposed and non-exposed portions 21a and 21b. In the illustrated embodiment, radiation with a wavelength of around 13 nm is used as the EUV radiation. Alternatively, any other radiation with a wavelength somewhere between 3 and 50 nm may also be used. The reflective mask 13 and reflection/demagnification optical system 25 may be the same as those used for the first embodiment.


Given the teachings of the references, it would have been obvious to one of ordinary skill in the art would have been motivated to perform the method of the Szmanda et al reference choosing to perform the exposure in a vacuum as in well known in the art and taught by the Irie references.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Amanda C. Walke whose telephone number is 571-272-1337. The examiner can normally be reached on M-R 5:30-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia Kelly can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Amanda C Walke
Primary Examiner
Art Unit 1752

ACW
June 17, 2007